GROWTH AND YIELD OF SWEET CORN (*Zea mays* var. *rugosa*) IN RESPONSE TO BIO-FERTILIZER APPLICATION

ABSTRACT

Bio-N® fertilizer is a substance which contains living microorganisms which, when applied to seed, plant surfaces, or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. This study was conducted to determine the effects of Bio-N® and different levels of inorganic fertilizers on the growth, yield and postharvest quality of sweet corn (*Zea mays* var. *rugosa*). The experiment was conducted using a 5m x 4m plot size and arranged as a 2x3 factorial experiment within a Randomized Complete Block Design. Bio-N application (with and without) was designated as Factor A, while the varying levels of inorganic NPK fertilizer (100%, 75%, 50%) were assigned as Factor B. This resulted in six treatment combinations, with each plot containing 108 sweetcorn plants, replicated three times.

Sweetcorn plants applied with Bio-N® fertilizer gave a significant growth and yield compared to those plants without fertilizer (Bio-N®) applied. The highest net income and return of investment were obtained from plants applied with Bio-N® with 100% RR of inorganic fertilizer at 284,866.00 and 316.05% respectively.

Keywords: Bio-N®, biofertilizer, sweet corn, Zea mays var. rugosa, growth, yield, inorganic fertilizers, NPK fertilizer, postharvest quality, randomized complete block design, net income, return on investment.

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INTRODUCTION

Sweet corn (*Zea mays* L. var. *rugosa*) is a mutant type of corn that differs from field or dent corn by a mutation at the sugary (*su*) locus. The sweet corn (*su*) mutation causes the endosperm (storage area) of the seed to accumulate about two times more sugar than field corn. Today several hundred sweet corn varieties are available. Recently, a number of new mutants have been used to improve sweet corn eating quality, particularly the sugary enhanced (*se*) and shrunken-2 (sh_2) genes.

Sweet corn remains an underutilized crop for production in European climates, including Slovenia, Austria, Germany, and the Czech Republic, due to climatic conditions that are less favorable for its cultivation compared to common maize (Fekonja et al., 2012, as cited by Bavec et al., 2015). Additionally, the adoption of biofertilizers in these regions is relatively low compared to certain developed and Asian countries, where these products have been widely recognized for their benefits and integrated into agricultural systems. Biofertilizers are defined as formulations containing naturally occurring microorganisms, such as nitrogen-fixing bacteria, phosphate-solubilizing microbes, or mycorrhizal fungi, which are artificially multiplied and applied to enhance soil fertility, improve nutrient availability, and boost crop productivity (Mazid & Khan, 2014). This limited utilization of biofertilizers in Europe presents an opportunity for further research and innovation to optimize agricultural productivity in the region.

In the Philippines, sweet corn production in 2018 reached 1.81 million metric tons (MMT), which was higher by 10.8 percent than the 2017 level of 1.63MMT. Harvest area increased to 612 thousand hectares from previous year's record of 571 thousand hectares. Yield per hectare improved from 2.85 metric tons (MT) to 2.95MT or by 3.5 percent (PSA, 2018). At present maize is being used to prepare more than 3,000 different consumable products worldwide. It is used for food purpose, livestock feed, poultry feed, starch and seed. To increase the production of maize, farmers are using different kinds of fertilizer to augment

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the production, however it creates burden of our struggling farmers who are constantly suffering from the high cost of chemical fertilizers.

Today, the demand for sweet corn continues to increase because of its nutritional content and palatable sensory attributes where, in all ages of human demographics consider it to be a good choice for snacks and even an option for meal. These facts had brought farmers to increase the usual production of sweet corn. Thus, considering it to be a good venture for farming business due to its increasing demand and shorter time of maturity in the field. However, soils have poor nutrient levels, prompting farmers to rely heavily on chemical fertilizers and pesticides for crop cultivation (Rajeshwar and Aarif Khan, 2009; Rajeshwar et al., 2010). Over time, excessive use of these chemicals has significantly reduced the population of beneficial microorganisms in the soil ecosystem. The continuous application of harmful substances has also diminished soil fertility and triggered the resurgence of various crop pests. Consequently, crop yields have declined, and production costs have risen. Furthermore, the extensive use of chemical inputs has caused severe damage to the soil environment (Rajeshwar et al., 2010).

On the other hand, biofertilizers were proven products advantageous over chemical fertilizers, as they provide nutrients in addition to plant growth promoting substances like hormones, vitamins, amino acids, (Shivankar et al., 2000), enriching the structure of soil (Rajeshwar et al., 2010; Roychowdhury et al., 2017) and efficient substitutes or supplements to inorganic fertilizer (BIOTECH-UPLB, 2018).

Likewise, bio-fertilizers in the market are of great numbers of different trade names and one of this is Bio-N®. It is a microbial-based fertilizer for corn; made from microorganism that has the ability to fix N from the air making it available for plant growth. It is isolated from the roots of talahib (*Saccharum spontaneum*). Also, it is cheaper, easy to use, safe and do not require repeated applications and locally available.

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Therefore, the study with the use of Bio-N® as growth enhancer/promoter and levels of inorganic fertilizers is a necessity in determining the growth, yield and postharvest quality of sweet corn that could eventually help local sweet corn farmers to reduce their dependence on synthetic fertilizers. Thus, this study was conducted.

Objectives of the Study

General Objective

The general objective of the study was to determine the effects of Bio-N® and different levels of inorganic fertilizers on the growth, yield and postharvest quality of sweet corn (*Zea mays* var. *rugosa*).

Specific Objectives

1.To determine the horticultural characteristics of sweet corn in terms of plant height (cm), number of leaves, number of days to tasseling and number of days to silking as applied with BIO-N® and different levels of inorganic fertilizers;

2. To measure the yield and yield components of sweet corn in terms of ear diameter (cm), ear length (cm), ear weight (cm), and yield (kg) as applied with BIO-N® and different levels of inorganic fertilizers;

3. To analyze the cost and return components of sweet corn as applied with BIO-N® and different levels of inorganic fertilizers.

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MATERIALS AND METHODS

Location and Duration of the Study

This study was conducted at Purok Ilaboon, Maniki, Kapalong, Davao del Norte, Philippines from September to December 2020. Barangay Araibo is situated at approximately 7.6268, 125.7213 in the island of Mindanao. Elevation at these coordinates is estimated at 27.4 meters or 89.9 feet above mean sea level. (https://www.philatlas.com/mindanao/r11/davao-del-norte/kapalong/maniki.html).

Experimental Design and Treatments b

The experiment was conducted using a 5m x 4m plot size and arranged as a 2x3 factorial experiment within a Randomized Complete Block Design. Bio-N application (with and without) was designated as Factor A, while the varying levels of inorganic NPK fertilizer (100%, 75%, 50%) were assigned as Factor B. This resulted in six treatment combinations, with each plot containing 108 sweetcorn plants, replicated three times. There were six treatment combinations and each plot have 108 sweetcorn plants replicated three times.

Factor A: Bio-N®

N1- With Bio-N®

N2- Without Bio-N®

Factor B: Levels of Inorganic Fertilizer

L1 – 100% RR of Inorganic NPK Fertilizer based on soil analysis (120-0-30 NPK kg./ha)

L2 – 75% RR of Inorganic NPK Fertilizer

L3 - 50% RR of Inorganic NPK Fertilizer

Treatment	Urea (grams/20sq.m)	Muriate of Potash (grams/20sq.m)
100% RR of Inorganic Fertilizer	522.0	100.0
75% RR of Inorganic Fertilizer	391.5	75.0
50% RR of Inorganic Fertilizer	261.0	50.0

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Sources of Materials and Variety Used

The materials used in the study are Macho F1 sweet corn seeds from east west company, Bio-N® fertilizer acquired from UP Los Banos, inorganic NPK fertilizer bought from Pacific Agrivet Supplies.

Soil Sampling, Preparation for Analysis

Soil analysis was done prior to planting to determine the required rate of fertilizer to be applied. Before the conduct of the experiment soil samples were collected randomly using shovel and bolo knife following *W* method in the experimental area. Soil samples were air dried for 7 days and then pulverized and sieved. A kilo of soil sample was submitted to the Bureau of Soils Laboratory of the Department of Agriculture Regional Field Office XI, in F. Bangoy St., Agdao, Davao City for analysis.

Cultural Practices and Management

Land Preparation

The 490 sq.m field was plowed two weeks before planting to induce decomposition of weeds and other stubbles using plough. A week after plowing, the field was harrowed twice until desired fineness of the soil is attained.

Planting

Sowing of sweet corn seeds was done in the field with plot size of 5m x 4m with spacing 75 cm x 25 cm at one seed per hill. Each plot represents the treatment replication. A one-meter alley was established between the second and third replications.

Fertilizer Application

The amount and kind of inorganic fertilizer materials used in the study was based on the routine analysis of the Bureau of Soils in Davao City. The Nutrient Requirement was 120-0-30 and the fertilizer recommendation are urea and muriate of potash. During planting, all

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muriate of potash and half of nitrogen fertilizer was applied in a band about 2 inches to the side and about 2 inches below the seed.

In using the Bio-N fertilizer, the corn seeds were placed in a container and moistened with a small amount of water and Bio-N was added. The moistened seeds and the Bio-N was mixed thoroughly until every seed is evenly coated with the fertilizer/inoculant. The seeds were planted immediately after inoculation since exposure to sunlight can kill microorganisms in the Bio-N.

Weeding and Cultivation

Manual weeding was done two weeks after planting and second weeding was done one month after planting. Weeding and cultivation was done at the same time, to minimize the competition in moisture and nutrient.

Insect Pest and Diseases Control

The corn plants in all treatments were sprayed with pesticides to prevent pests and diseases from attacking the plants. This was done at early and late stages to prevent corn borer infestation.

Harvesting

The sweet corn was harvested 73 days after planting by cutting the whole plant and the corn ear was manually picked. This was done early in the morning to prevent conversion of sugar into starch. Harvested ears were placed in clean basket and labeled properly according to treatments.

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Data Gathered

A. Horticultural Characteristics

1. **Plant height (cm).** This was taken by measuring randomly ten (10) samples per plot measuring from the base of the plant up to its highest leaf using meterstick. Measurement was recorded at 15, 30, 45 and 60 days after sowing.
2. **Number of leaves.** This was taken by counting the fully expanded leaves of the ten (10) randomly selected samples per plot. This was done at 15, 30, 45 and 60 days after sowing.
3. **Number of Days to Tasseling.** This was determined by counting the number of days from the time of sowing up to the time when 50% of the plants in the plots bear tassels.
4. **Number of Days to Silking.** This was determined by counting the number of days from the time of sowing up to the time when 50% of the plants produce silk.

B. Yield and Yield Component

1. **Ear Weight (g).** This was determined by weighing the ten (10) randomly selected ears per plot of fresh corn ears before and after dehusking using a digital weighing scale.

2. Ear Length (cm). This was determined by measuring the average length of ten (10) randomly selected corn ear per treatment using tapemeasure.

3. Ear Diameter (cm). This was determined by measuring the middle portion of the ten (10) randomly selected corn ears per treatment using a measuring tape.

4. Sweetcorn Yield (kg/ha.) This was determined using the formula below:

$$\text{Yield (kg/ha)} = \frac{\text{plot yield (kg)}}{\text{plot size (m}^2\text{)}} \times \frac{10{,}000\ \text{m}^2\text{/ha}}{1{,}000\ \text{kg/ton}}$$

5. **Cost and Return Analysis**

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The Return of Production Cost (RPC) was computed using the formula below:

$$RPC = \frac{\text{Net Income}}{\text{Total expenses}} \times 100$$

Statistical Analysis

The data gathered were analyzed using Analysis of Variance (ANOVA) in Two-Factorial in Randomized Complete Block Design (RCBD). The significant difference among treatment means was further analyzed using Honestly Significant Difference (HSD) Test at 5% level of significance.

RESULTS AND DISCUSSIONS

A. Field Condition

Successful sweet corn farming depends on various factors not only on the variety to be cultivated, nutrient management and cultural practices to be employed but also on the field condition to where this crop will be planted. This research was conducted from September 20 to December 3, 2020. Presented in Table 1 is the average temperature, relative humidity and rainfall during the entire duration of the study at Purok Ilaboon, Maniki, Kapalong, Davao del Norte Kapalong. The data shows that the area condition in terms of temperature, relative humidity and rainfall are favorable for corn production.

The Department of Agriculture and Fisheries (1980), as cited by Binas (2018) reported that the optimum temperature requirement for normal growth and development of corn stands is 24 to 28^{0}C. Likewise, Jacobson (2016) also reported that sweetcorn needs of 20 to 30^{0}C for germination. The relative humidity of 81 to 89% was also favorable for growth and development of sweetcorn.

Moreover, the location also underwent soil analysis prior to the conduct of the study. The area measures 0.5 hectare and has plain topography. The area generally relies on rainfed irrigation. The area was previously planted with ‘Cavendish’ banana. However, during the conduct of the study, the area has no obstacles as there was no existing trees or shrubs and the plants received full sunlight exposure making it ideal for planting sweet corn.

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Table 1. Average temperature, relative humity (RH) and rainfall per month recorded within the study location throughout the duration of the experiment (retrieved from:MDRRMO,Kapalong, Davao del Norte last January 3, 2021).

Observation Period (2020)	**Parameters**		
	Average Temperature (0C)	**Average RH (%)**	**Average Rainfall (mm)**
September	29.00	82.00	207.00
October	28.00	81.00	210.00
November	29.00	77.00	196.00
December	28.00	82.00	170.00

Moreover, the Cultural Management of Corn, ATI-CO (2014), stated that corn may be planted anytime of the year provided there is adequate soil moisture. However, it is best to plant from May to June during the wet season and from October to November during the dry season. The National Rain Stimulation Office, Bureau of Soil and Water Management. 1991, also added that in the Philippines, temperature variations during the maize cropping seasons do not critically affect the maize crop as do rainfall variations.

B. Agronomic Characteristics:

Plant Height (cm)

Plant height of corn is an important plant performance indicator. Shown in Table 2 is the data for plant height of sweet corn as influenced by Bio-N® application and different levels of inorganic fertilizers under field condition. Analysis of variance revealed that the Bio-N® application and levels of inorganic fertilizers significantly influenced the plant height of sweet corn.

Table 2.
Plant Height of Sweet Corn as affected by Bio-N® application and different levels of inorganic fertilizers.

TREATMENTS	PLANT HEIGHT (cm) *1*			
	Days After Sowing (DAS)			
	15 DAS	**30 DAS**	**45 DAS**	**60 DAS**
Bio-N® Application	*	*	**	*
with Bio-N	24.94 a	121.46 a	197.14 a	220.69 a
without Bio-N	22.68 b	114.36 b	187.73 b	216.34 b
Levels of Inorganic Fert.	*	*ns*	*	**
100% of RR	25.50 a	123.47	199.32 a	223.13 a
75% of RR	23.32 ab	116.82	192.42 ab	217.75 b
50% of RR	22.62 b	113.43	185.58 b	214.67 b
cv (%)	**7.29**	**5.40**	**3.24**	**1.36**

1- The same letter do not differ significantly at 0.05 level using HSD; ***ns*** *denotes not significant;* ***** *denotes significant;* ****** *denotes highly significant.*

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Furthermore, it appeared that plants applied with Bio-N® had taller plant height compared to those without Bio-N® application as evident on day 15 of observation onwards (Table 1). For the level of inorganic fertilizer, it appeared that the rate of 100% of RR had taller plant height as manifested on days 15, 45 and 60. However, this treatment had comparable statistical result with 75% of RR on days 15 and 45.

On the other hand, the interaction effects of Bio-N application and level of inorganic fertilizers failed to show any significant difference among treatments with respect to plant height of sweet corn.

The results of this experiment conforms the research of Hassan Amin (2016) which states that Bio-N alone significantly affect the plant height, stem diameter, number of days to 50% tasseling of fodder maize. It shows that available nitrogen enhances protein synthesis, division and enlargement of cells as well as it is important for the photosynthetic processes.

Moreover, Fawzy Z.F. et.al (2012) also mentioned that using biofertilizer significantly increased the vegetative growth characters (plant length, number of leaves and stems/ plant except for number of shoots) in sweet pepper. The superiority of using the bio fertilizer compared to control (without bio fertilizer) may be due to the release of the fixing nitrogen, hence increasing the concentration and availability of N in the root zone. These results may be due to the role of N-free living bacteria in production of phytohormones or improving the availability and acquisition of nutrients or by both and this may explain the encouraged growth of plants inoculated with these non – symbiotic N-fixing bacteria.

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Number of Leaves

Determining the number of leaves per plant is important in deciding the population density which is vital in determining grain yield and other important horticultural attributes of a crop. In this study, the number of leaves of sweet corn were counted to determine the interaction effects of Bio-N® application and levels of inorganic fertilizers under field condition

(Table 2). Result of the statistical analysis revealed that the number of leaves of sweet corn was influenced by Bio-N® application and levels of inorganic fertilizers.

In terms of Bio-N® application, results showed that plants applied with Bio-N® developed more leaves than those plants with no Bio-N® application as observed on days 30 to 60 (Table 3). It also appeared that those plants applied with 100% RR of inorganic fertilizer established more leaves than 75% and 50% of RR as evident on days 39 and 45. However, 75% RR is comparable with 100% on day 45.

This study also indicated that the interaction effects of Bio-N® application and level of inorganic fertilizers failed to show any significant difference on the number of leaves of sweet corn among all treatment combinations.

Table 3.
Number of leaves of Sweet Corn as affected by Bio-N® application and different levels of inorganic fertilizers.

TREATMENTS	NUMBER OF LEAVES [1]			
	Days After Sowing (DAS)			
	15 DAS	**30 DAS**	**45 DAS**	**60 DAS**
Bio-N® Application	*ns*	*	**	**
with Bio-N	4.21	8.83 a	11.46 a	12.81 a
without Bio-N	4.02	8.29 b	10.61 b	12.19 b
Levels of Inorganic Fert.	*ns*	*	*	***ns***
100% of RR	4.27	8.97 a	11.53 a	12.78
75% of RR	4.08	8.38 b	10.97 ab	12.50
50% of RR	4.00	8.33 b	10.60 b	12.22
cv (%)	**6.35**	**4.84**	**4.10**	**3.14**

1- The same letter do not differ significantly at 0.05 level using HSD; ***ns*** *denotes not significant;* ***** *denotes significant;* ****** *denotes highly significant.*

It is interesting to notice that the result of this study supports the findings of Abou El-Magd, et al. (2014) which concluded that chili pepper treated with Bio-N had higher vegetative growth such as plant length, number of leaves and fresh weight of fruits than the untreated plants. This is also shown that same with chilli pepper, the effect of Bio-N on growth and the

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different inorganic fertilizers, yield and quality of fodder maize (Zea mays L.) affects the growth attributes of plant in terms of the number of leaves, leaf area, leaf area index (Hassan Amin, 2016).

Number of Days to Tasseling

The tassel of a corn is completely visible when the plant has reached its full height and will begin to shed its pollen. Determining the day as to when a corn plant will exhibit tassel formation is important to evaluate its growth and development. Presented in Table 4 is the number of days to tasseling of Sweet Corn as influenced by Bio-N® application and different levels of inorganic fertilizers.

Table 4.
Number of Days to Tasselling and Silking of Sweet Corn as affected by Bio-N® application and different levels of inorganic fertilizers.

TREATMENTS	HORTICULTURAL PARAMETERS *1*			
	# of Days to Tasselling		# of Days to Silking	
Bio-N® Application		**		**
with Bio-N	47.67	a	52.78	a
without Bio-N	49.11	b	54.67	b
Levels of Inorganic Fert.		**		**
100% of RR	46.67	a	51.83	a
75% of RR	48.67	b	54.00	b
50% of RR	49.83	c	55.33	c
cv (%)	**1.29**		**0.88**	

*1- the same letter do not differ significantly at 0.05 level using HSD; **ns** denotes not significant; * denotes significant; ** denotes highly significant.*

Analysis of variance revealed that the Bio-N® application as well as the levels of inorganic fertilizers significantly influenced the number of days to tasseling of sweet corn while the interaction effects were otherwise (Table 4).

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In terms of Bio-N® application, plants applied with Bio-N® have shorter days to form tassel as compared to non-application of Bio-N®. It further showed that it only took an average of 47.67 days as compared to 49.11 days of the latter. On the other hand, those plants applied with 100% RR of inorganic fertilizer had the shortest day of tassel formation with only 46.67 days average.

Nonetheless, the interaction effects of these two factors being studies showed no significant difference.

According to Hassan Amin, (2016) Bio-N significantly influence not only the plant height and stem diameter but also the number of days to 50% tasseling of fodder maize. This only shows that with the use of lone Bio-N fertilizer, the plants applied with Bio-N have shorter days to form tassel as compared to non-application of Bio-N which the manifestation was shown in this experiment.

Consequently, this contradicts the findings of Lina, et al (2014) stating that corn plants applied with organic fertilizer, either singly or in combination, of either Bio-N, chicken dung or vermicast and other inorganic fertilizer, produced tassel and silk and matured earlier comparable to those applied with inorganic fertilizer alone.

Number of Days to Silking

Three (3) days after the tasseling stage, silking usually occurs. Reflected in Table 4 are the number of days to silking of Sweet Corn as influenced by Bio-N® application and different levels of inorganic fertilizers. Result of the statistical analysis revealed that the both factors being studied (Bio-N® application and levels of inorganic fertilizers) were statistically significant while their interactions effects have no significant difference among treatment combinations.

Results further showed that sweet corn plants applied with Bio-N® have shorter days of silking with only 52.78 days on average compared to plants with no application of Bio-N®.

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On the other side, plant applied with 100% RR of inorganic fertilizer have shown to have shorter days of silking compared to other level of inorganic fertilizer. It only took an average of 51.83 days compared to 75% of RR with 54 days and 50% of RR with 55.33 days.

Excitingly, the findings of the experiments were also supported by Maswita (2014) that time of tasseling and silking is very determined by various factors that affect the flowering of plants is soil fertility which is greatly affected by the use of Bio-N fertilizer. Flowering can be successful if soil fertility allows plants to grow and healthy. Similar with the number of days of tassel formation, the interaction effects did not show any significant difference on the number of days to silking among treatment combinations which was supported by Asaduzzaman, et. al., (2014) stating interaction between Bio-N and other fertilizer was found significant to days for first tasseling and days to silking.

C. Yield and Yield Components

Ear Diameter (cm), length (cm) and weight (g)

It is important to quantify yield components as these components determine yield. Table 5 presents the data on the yield components of sweet corn as influenced by the application of Bio-N® and levels of inorganic fertilizer. These components include ear diameter, ear length and ear weight. The yield was also measured using a weighing scale after the ears has been dehusked.

Result in the ANOVA revealed that Bio-N® application (factor A) significantly influenced all the yield components while on the levels of inorganic fertilizer, only the ear diameter appeared to have significant difference among treatments. Moreover, the interaction effects failed to show any significant difference on the yield components among treatment combinations.

In terms of ear diameter (Table 5), plants applied with Bio-N® have bigger ear diameter compared to plants without Bio-N® application. In terms of the levels of inorganic fertilizer,

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the application of 100% RR resulted in a larger ear diameter; however, analysis of variance revealed that this was statistically comparable to the ear diameter achieved with 75% RR application.

Table 5.
Yield and Yield Components of Sweet Corn as affected by Bio-N® application and different levels of inorganic fertilizers.

TREATMENTS	YIELD AND YIELD COMPONENTS 1									
	Parameters									
	Ear Diameter (cm)		Ear Length (cm)		Ear Wt (g) before		Ear Wt (g) after		Yield (kg)	
Bio-N® Application	*		*		**		**		**	
with Bio-N	5.19	a	21.79	a	279.60	a	204.67	a	29.22	a
without Bio-N	5.03	b	21.31	b	255.83	b	187.18	b	26.78	b
Levels of Inorganic Fert.	*		*ns*		*ns*		*ns*		*	
100% of RR	5.20	a	21.69		277.50		201.32		29.00	a
75% of RR	5.13	ab	21.45		264.20		195.80		27.83	ab
50% of RR	5.00	b	21.51		261.45		190.65		27.17	b
cv (%)	**2.09**		**2.07**		**4.25**		**5.25**		**3.75**	

*1- the same letter do not differ significantly at 0.05 level using HSD; **ns** denotes not significant; * denotes significant; ** denotes highly significant.*

In terms of ear length, results revealed that plants with Bio-N® application has longer ear length (21.79 cm) compared to plants without Bio-N® treatment (21.31 cm). However, the levels of inorganic fertilizer did not showed any significant difference which is similar to the interactions effects.

The ear weight before and after dehusking was also measured. Results showed that all plants treated with Bio-N® have greater ear weight consistently before and after dehusking. The ear weight of sweet corn with Bio-N® applied reached an average of 279.60g and 204.67g, before and after dehusking, respectively, while those plants without Bio-N® have an average ear weight of 255.83g and 187.18g, respectively. In terms of the levels of inorganic fertilizer, results revealed no significant difference among treatments similar to that of the interactions effects.

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These findings were similarly interpreted by the Central Bureau of Statistics (2016) stating that the effect of treatment on the ear of corn weight, ear of corn diameter and ear of corn length component was manifested in the yield of sweet corn. The ear of corn weight was closely related to the ear of corn diameter and ear of corn length. Long ear of corn with large diameter, and many corn rows will produce large ear of corn weight. The results of the sweet corn crop will increase in line with the nature of the sweet corn. Based on the ear of corn weight, the ear of corn diameter and the ear of corn length, the treatment with Bio-N showed good results when compared to the treatment without Bio-N.

In contrary, the finding of the experiment was contradicted by International Seminar and Congress of Indonesian Soil Science Society (2019) that there was a great increase in yield sweetcorn and yield components, nutrient concentrations of maize crop with the integrated application of Bio-N and inorganic fertilizers relatively different compared to the independently use or the control. The maximum yield sweetcorn and yield components nutrients uptake, the ear of corn weight, the ear of corn diameter and ear of corn length. This experiment showed that the productivity of sweet corn is considerably higher when farmers use integrated soil fertility management options.

Yield (kg)

The primary objective of production of whatever crops is to produce yield of the right quality, right quantity, at the right time and at minimum cost. Table 5 also presents not only the data on the yield components of sweet corn but also on the yield per se as influenced by the application of Bio-N® and levels of inorganic fertilizer. Analysis of variance revealed that the yield was influenced by the application of Bio-N® as well as on the levels of inorganic fertilizer, but not true with its interaction effects.

Sweet corn plants applied with Bio-N® have greater yield compared to those plants without Bio-N® application. On the levels of inorganic fertilizer, it appeared that those plants

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applied with 100% RR of inorganic fertilizer produced more yield but comparable to 75% RR (Table 5). However, similar to other yield components, the interaction effects showed no significant difference among treatment combinations.

The significantly longer and bigger ears contributed to the significant weight of the yield of treated plants. Thus, the treated plants significantly obtained the higher kilogram per plot compared to without Bio-N application. This is the manifestation that BIO-N can be considered as a "breakthrough technology" that promises very significant impact on the country's rice and corn farmers in terms of increasing farm productivity and income (Garcia, 2004).

D. **Cost and Return Analysis**

Table 6 presents the computed yield and cost of production of a 1-hectare sweet corn farm per treatment combination. Among all treatments, it appeared that treatments Bio-N® application combined with 100% RR of inorganic fertilizer has the highest RPC with 316.05%.

The result implies the benefit of the combination of Bio-N and inorganic fertilizer plus the favorable atmospheric condition on the significant increase yield of sweetcorn. Ojeniyi (2002) as cited by Binas (2018), reported that the combination of organic and inorganic fertilizers can improve yield of corn crop which significantly affects income.

Table 6.
Return of Production Cost (RPC) of 1-hectare Sweet Corn farm applied with Bio-N® and levels of inorganic fertilizers.

TREATMENTS	Return of Production Cost				RPC %
	Yield (kg/ha)	Gross Income (@25/kilo)	Cost of Production / hectare	Net Income	
T1 (BIO-N + 100% of RR)	**15,000**	**375,000.00**	**90,134.00**	**284,866.00**	**316.05**
T2 (BIO-N + 75% of RR)	**14,666**	**366,650.00**	**87,961.50**	**278,688.50**	**316.83**
T3 (BIO-N + 50% of RR)	**14,166**	**354,150.00**	**84,851.50**	**269,298.50**	**317.38**
T4 (100% of RR)	**14,000**	**350,000.00**	**89,894.00**	**260,106.00**	**289.35**
T5 (75% of RR)	**13,166**	**329,150.00**	**87,721.50**	**241,428.50**	**275.22**
T6 (50% of RR)	**13,000**	**325,000.00**	**84,611.50**	**240,388.50**	**284.11**

SUMMARY

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The study was conducted to determine the effects of Bio-N® and different levels of inorganic fertilizers to growth, yield and postharvest quality of sweet corn (*Zea mays* var. *rugosa*). Specifically, it aimed to (i) to determine the horticultural characteristics of sweet corn in terms of plant height (cm), number of leaves, number of days to tasseling and number of days to silking as applied with BIO-N® and different levels of inorganic fertilizers; (ii) to measure the yield and yield components of sweet corn in terms of ear diameter (cm), ear length (cm), ear weight (cm), and yield (kg) as applied with BIO-N® and different levels of inorganic fertilizers; (iii) to determine the postharvest quality of sweet corn in terms of color, aroma, texture, taste and general acceptability and Total Soluble Solid (TSS) as applied with BIO-N® and different levels of inorganic fertilizers; and (iv) to analyze the cost and return components of sweet corn as applied with BIO-N® and different levels of inorganic fertilizers.

The experiment was conducted using a 5m x 4m plot size and arranged as a 2x3 factorial experiment within a Randomized Complete Block Design. Bio-N application (with and without) was designated as Factor A, while the varying levels of inorganic NPK fertilizer (100%, 75%, 50%) were assigned as Factor B. This resulted in six treatment combinations, with each plot containing 108 sweetcorn plants, replicated three times. Treatment combinations are without Bio-N +100% RR inorganic (T1), without Bio-N +75% RR inorganic(T2) , without Bio-N +50% RR inorganic(T3) , with Bio-N +100% RR inorganic(T4) , with Bio-N +75% RR inorganic(T5) , with Bio-N +50% RR inorganic(T6). Data were analyzed through 2x3 factorial Analysis of Variance (ANOVA) using statistical software package. Significant differences between treatment means were analyzed using Tukey's Honest Significant Differences (HSD) at 5% level of significance.

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CONCLUSION AND RECOMMENDATION

Sweetcorn applied with Bio-N® fertilizer gave favorable growth and yield performance. Application of combined Bio-N® and 100% RR of inorganic fertilizer was greatly profitable for it gained highest net income and ROI of 284,866.00 and 316.05%, respectively. It can can be concluded that BIO-N® can be considered as a "breakthrough technology" that promises very significant impact on the country's rice and corn farmers in terms of increasing farm productivity and income.

The application of BIO-N® fertilizer is recommended for sweetcorn production. BIO-N® fertilizer compensate the deficiency of the nutrients to crops and of corn plants increased the vegetative growth and improved the yield. Moreover, Bio-N fertilizers have several advantages over chemical fertilizers, they are non-pollutant, in-expensive, utilize renewable resources. A similar study may be conducted to evaluate further the growth, yield and postharvest quality of sweetcorn under different agroclimatic conditions.

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